WHAT IS CLAIMED IS:

[c1] 1. A method of reconstructing 3-dimensional information of an object from projection images acquired by a digital tomosynthesis system having an x-ray source following a trajectory relative to a detector and said object, said method comprising:

determining mathematical relationships between sinusoidal components of logical slices through the object with sinusoidal components of projection images of the object.

[c2] 2. The method as in claim 1, further comprising:

dividing the object logically into planes of varying respective distances from and parallel to a detector detecting the projection images; and

reconstructing 3-dimensional information about the object from 2-dimensional information about the object included in the projection images detected by the detector for different focal spot positions of the x-ray source.

[c3] 3. The method as in claim 2, wherein said 2-dimensional information includes amplitudes and phases of the coefficients of the sinusoidal components of the projection images being detected by the detector.

[c4] 4. The method as in claim 2, wherein the reconstructing is based upon respective phases and amplitudes of the sinusoidal components of the projection images detected by the detector.

[c5] 5. A method of reconstructing 3-dimensional images of an object based upon 2-dimensional data of the object detected by a digital tomosynthesis system in which an x-ray source traverses a trajectory a constant distance from a detector, said method comprising:

acquiring projection images of the object at different focal spot positions of the x-ray source;

determining a two-dimensional Fourier Transform of each of the projection images;

for each frequency considered in the Fourier Transform, collecting Fourier coefficients of the corresponding frequency component for each of the projection images;

determining a mathematical relationship between the Fourier coefficients and vertical profiles of Fourier coefficients at corresponding frequencies;

determining an optimal vertical profile for each frequency by determining a linear combination of certain characteristic vertical profiles associated with that frequency and the focal spot locations which is a best approximation of the vertical profile of the Fourier coefficients at corresponding frequencies;

for each height above the detector and within the object, collecting the Fourier coefficients of all frequencies at the height by determining the values of the corresponding optimal vertical profiles at the height;

for each height, determining the inverse Fourier Transform of the Fourier coefficients; and

reconstructing the 3-dimensional image of the object by collecting the results of the inverse Fourier Transform in a volumetric stack of reconstructed slices.

[c6] 6. The method as in claim 5, further comprising:

restricting the reconstruction to a predetermined volume in which the object is present by eliminating all non-zero components of the reconstruction outside of that volume;

for each focal spot position, computing a corresponding second projection of the reconstructed object whose spatial extent is limited to the predetermined volume;

computing a difference between the projection and the second projection; and

determining a final reconstruction by using the difference between the projections as input to the determining a two-dimensional Fourier Transform and repeating once each subsequent process up to and including the reconstructing the 3-dimensional image of the object, and subsequently adding this result to the previously reconstructed object.

[c7] 7. The method of claim 6, wherein the restricting the reconstruction, the computing a corresponding second projection, the computing a difference, and the determining are repeated iteratively.

[c8] 8. The method as in claim 5, further comprising:

restricting the reconstruction to a predetermined range of values in the reconstructed object by eliminating all non-zero components of the reconstruction outside of the predetermined range of values;

for each focal spot position, computing a corresponding second projection of the reconstructed object whose spatial extent is limited to the predetermined range of values;

computing a difference between the projection and the second projection; and

determining a final reconstruction by using the difference between the projections as input to the determining a two-dimensional Fourier Transform and repeating once each subsequent process up to and including the reconstructing the 3-dimensional image of the object, and subsequently adding this result to the previously reconstructed object.

[c9] 9. The method of claim 8, wherein the restricting the reconstruction, the computing a corresponding second projection, the computing a difference, and the determining are repeated iteratively.

[c10] 10. A method of imaging an object by a digital tomosynthesis system in which an x-ray source traverses a trajectory relative to and at a constant distance from a detector plane, comprising:

emitting by a source of the digital tomosynthesis system x-rays at varying focal spots, said x-rays impinging upon and passing through said object;

detecting by a detector of the digital tomosynthesis system the x-rays passing through the object; and

reconstructing 3-dimensional images of the object based upon phases and amplitudes of sinusoidal components of the projection images.

[c11] 11. The method as in claim 10, wherein the focal spot positions of the x-ray source are located at a constant distance from the detector plane.

[c12] 12. The method as in claim 10, wherein the reconstructing comprises determining vertical Fourier coefficient profiles through the object.

[c13] 13. The method as in claim 10, wherein the reconstructing 3-dimensional information reconstructs 3-dimensional information about structures which are located at varying heights within the object.

[c14] 14. A digital tomosynthesis system imaging an object and comprising:

an x-ray source emitting x-rays and traversing a trajectory within a logical plane;

a detector provided opposite from the x-ray source with respect to the object and located in a plane parallel to the plane of the x-ray source trajectory, said detector receiving the x-rays transmitted by the x-ray source; and

a computer coupled to the detector and reconstructing 3-dimensional images of the object by determining mathematical relationships between sinusoidal components of logical slices through the object with sinusoidal components of projection images of the object.

[c15] 15. The digital tomosynthesis system as in claim 14, wherein the digital tomosynthesis system divides the object logically into planes of varying respective distances from and parallel to a detector detecting the projection images, emits at focal

spots by a source into the object x-rays , and reconstructs 3-dimensional information about the object from 2-dimensional information about the object included in the projection images detected by the detector.

[c16] 16. The digital tomosynthesis system as in claim 15, wherein said 2-dimensional information includes amplitudes and phases of the coefficients of the Fourier Transform of the projection images being detected by the detector.

[c17] 17. The digital tomosynthesis system as in claim 15, wherein the reconstructing is based upon respective phases and amplitudes of the sinusoidal components of the projection images detected by the detector.

[c18] 18. The digital tomosynthesis system as in claim 15, wherein the x-ray source traverses a linear trajectory.

[c19] 19. The digital tomosynthesis system as in claim 15, wherein the x-ray source traverses a circular trajectory a constant distance from the detector plane.

[c20] 20. The digital tomosynthesis system as in claim 18, wherein the linear trajectory is parallel to rows or columns of the detector.

[c21] 21. The digital tomosynthesis system as in claim 15, wherein focal spots of the x-ray source remain in a plane parallel to a plane containing the detector.

[c22] 22. The digital tomosynthesis system as in claim 18, wherein the computer determines two-dimensional reconstructions of planes containing the source trajectory, and assembles the two-dimensional reconstructions into a 3-dimensional reconstruction.

[c23] 23. A computer readable medium storing a program which when executed by a computer causes the computer to execute the processes comprising:

reconstructing 3-dimensional information of an object detected by a digital tomosynthesis system including an x-ray source traversing a trajectory located a constant distance from a detector by determining a mathematical relationship between

sinusoidal components of logical slices through the object with sinusoidal components of projection images of the object.

[c24] 24. A digital tomosynthesis system imaging an object and comprising:

an x-ray source emitting x-rays and traversing a trajectory within a logical plane;

a detector provided opposite from the x-ray source with respect to the object and located relative to the x-ray source trajectory wherein the detector is located in a plane that is non-parallel to the plane of the x-ray source trajectory, said detector receiving the x-rays transmitted by the x-ray source; and

a computer coupled to the detector and reconstructing 3-dimensional images of the object by determining mathematical relationships between sinusoidal components of logical slices through the object with sinusoidal components of projection images of the object.

[c25] 25. A method of re-constructing 3-dimensional information of an object from projection images acquired by a digital tomosynthesis system having an x-ray source following a trajectory relative to a detector and said object, said method comprising:

dividing the object logically into planes of varying respective distances from an parallel to the detector detecting the projection images;

determining mathematical relationships between Fourier transforms of the logical slices though the object a predetermined frequencies with Fourier transforms of projected images of the object at said predetermined frequencies;

reconstructing 3-dimensional information about the object at said predetermined frequencies from 2-dimensional information about the object included in the projection images detected by the detector for different focal spot positions of the x-ray source; and

reconstructing 3-dimensional information about the object at frequencies other than said predetermined frequencies using a non-Fourier transform reconstruction technique.